

REMARKS

In view of the above amendments and following remarks, reconsideration of the rejections contained in the Office Action of March 22, 2004 is respectfully requested.

Without acquiescing to the positions taken by the Examiner, claims 52-55 have now been canceled to attempt to speed the prosecution of this application.

In section 4 on page 3 of the Office Action, the Examiner rejected claim 51 because claim 51 recites "slowly cooling comprises cooling the raw material melt with a temperature drop rate of $0.1^{\circ}\text{C}/\text{day}$." The Examiner noted that the specification "merely teaches descending the temperature at a rate of $0.1^{\circ}\text{C}/\text{day}$ on page 11. The instant specification does not teach the means which is used to obtain the cooling rate or any method of obtaining such a slow rate of cooling." This position by the Examiner is respectfully traversed. It is respectfully submitted that it would be clear to one of ordinary skill in the art from what is disclosed in the specification how to obtain a cooling rate of $0.1^{\circ}\text{C}/\text{day}$. Turning to page 10 of the specification, beginning with paragraph 34, is begun a description of single crystal growth as an example of the invention. Paragraph 34 describes using the "aforementioned growing apparatus." The apparatus includes the structure of Fig. 2 which includes resistance heating heaters and control sensors. It is further noted that the maximum heating temperature of the raw material melt was set to 900°C as described in paragraph 36. As the Examiner notes, at the top of page 11 is described a temperature descending rate of $0.1^{\circ}\text{C}/\text{day}$. As described in paragraph 38, a temperature of the melt was made to descend at a rate of $0.1^{\circ}\text{C}/\text{day}$. The temperature was measured by control sensors and the temperature of the whole melt was made to descend equally at a rate of $0.1^{\circ}\text{C}/\text{day}$.

It is respectfully submitted that it would be clear to one of ordinary skill in the art that appropriate control of the descending rate can be made by use of the control sensors and the resistance heating heaters. Accordingly, the information contained in the specification is sufficient to enable one of ordinary skill in the art to make and use the invention described in claim 51. Accordingly, withdrawal of this rejection of claim 51 is respectfully requested.

The Examiner further rejected claim 37 (along with claim 38) over Nakagawa et al., Japanese reference 63-190794, in view of Kamio et al., U.S. Patent 5,126,144. However, claim 37, along with its dependent claims, clearly distinguishes over these two references.

The present invention as set forth in claim 37 is a method of growing a single crystal. The claim requires bringing a seed crystal into contact with a raw material melt which is heated and melted within a crucible by a resistance heating heater and growing a single crystal. The claim further requires rotating the crucible without rotating a blade member having a screw form in the crucible in the raw material melt during the growing. The blade member is located at a position corresponding to the center of rotation of the crucible and adjacent to the inside bottom of the crucible so as to stir the raw material melt in the crucible. It is further noted that the claim recites slowly cooling the raw material melt so that a difference in temperature of the raw material melt between different positions along an extent from the liquid level to a depth of 10 cm is in a range from -0.5° to 0°C .

Noting page 7 of the specification, beginning at line 4, the presence of the blade member 5 with the rotation of the crucible enhances the effect of stirring of the raw material melt. This makes it possible to make the diffusion boundary layer thin, to increase the amount of the raw materials to be supplied to the growth surface and to make the degree of supersaturation uniform. This enables the growth of a high quality and high performance single crystal even if the raw material melt is highly viscous at the growth temperature.

As described on page 11, Fig. 5 shows a hysteresis of the crystal when compared with that of a conventional method and Fig. 6 shows the distribution of temperature in the raw material melt. From Fig. 6, it can be seen that the distribution of temperature of the melt in the crucible is made more uniform in the direction of height than with respect to the conventional method, and the crystal is thus grown uniformly. As described in paragraph 40, with relation to Fig. 6, the temperature difference between positions from the liquid level to a depth of about 10 cm is in a range of -0.5°C to 0°C . Thus as discussed on page 12, with a blade member inserted and the crucible rotated, growth at the start is faster than with a conventional growth.

Nakagawa discloses a method and device for producing a single crystal in which a blade 1 is fitted to a vertical moved shaft 2 concentrically with a pulling-up shaft 4. Before pulling up a single

crystal 3, scum 5, incorporating on the surface of melt 6 of a raw material or in a liquid sealant 9, is purged to the vicinity of the wall of a crucible 7 by using this blade 1.

It is noted that the blade 1 is in scum 5, and not in liquid 6. Note also Fig. 3 attached to this document. It is further noted that the process described in Nakagawa appears to take place before pulling single crystal 3, as described under "constitution." Accordingly, it is submitted that Nakagawa clearly fails to disclose or suggest rotating the crucible without rotating the blade member in the crucible in the raw material melt during the growing so as to stir the raw material melt in the crucible. Indeed, this distinction incorporates a number of separate differences. The blade member 1 of Nakagawa is not in the melt during the growing. It does not stir the raw material melt in the crucible, further; rather, it is positioned in the scum 5 above the surface of melt 6. In addition, the blade member 1 is not located at a position corresponding to the center of rotation of the crucible and adjacent to the inside bottom of the crucible, as also required by claim 37.

The Examiner states that in Figure 2 the blade member 1 is located at the center of rotation of the crucible and adjacent to the inside bottom of the crucible in Figures 1 and 3. However, it is not so-located during the growing. The Examiner further states that Nakagawa discloses rotating the crucible, referring to Figure 3. Again, none of the steps illustrated in Figure 3 take place during the growing, but during the operation concerning the blade member 1.

The Examiner states that Nakagawa does not teach the raw material melt being heated and melted within a crucible by resistance heater. However, as discussed above, there are many other deficiencies with respect to claim 37 in Nakagawa.

The Examiner's citation of Kamio does not cure the above deficiencies of Nakagawa. Kamio aims to stabilize crystal growth by not changing a surface level by supplying something of the same composition as the crystal that is pulled up in the solution. In case additional material is supplied, it is not supplied near the grown crystal, it is supplied from outside the partition of the inner crucible, and uniformity is achieved by the convection of the solution.

The Examiner acknowledges that the combination of Nakagawa and Kamio does not teach the difference in temperature of the raw material melt between different positions as recited in claim 37. However, the Examiner considers this feature inherent. This position by the Examiner is clearly

wrong as a matter of law. There is nothing whatsoever to indicate that any such temperature difference would be inherent from Nakagawa and Kamio, even if they could be combined. Even if the method of Nakagawa and Kamio could be considered similar to the present invention, it would not result in this feature being inherent. Inherency is something that must flow as a natural consequence of what is in the prior art. The temperature difference is not such a natural consequence from the method of Nakagawa described above, even in consideration of Kamio. The Examiner has cited no evidence to support this position, further. Thus, it may be seen that the reference to this temperature difference even further distinguishes the present invention over Nakagawa and Kamio.

Thus, from the above it is readily seen that the prior art cited by the Examiner does not disclose or suggest rotating the crucible during the growing, rotating the crucible without rotating a blade member having a screw form in the crucible in the raw material melt during the growing, the blade member being located in a position in the raw material melt during the growing and adjacent to the inside bottom of the crucible, and the temperature difference as further recited.

Thus, it is respectfully submitted to be clear that claim 37 patentably distinguishes over both Nakagawa and Kamio. Indication of such is respectfully requested.

The additionally cited art fails to cure the above-described deficiencies of Nakagawa and Kamio, furthermore.

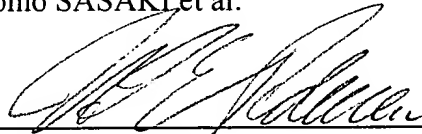
As claim 37 is the only remaining independent claim, it is respectfully submitted that all of the claims now pending in the present application patentably distinguish over all of the prior art cited by the Examiner. Indication of such is respectfully requested.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicants' undersigned representative.

Respectfully submitted,

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